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EARTH SCIENCES

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I. OCEANOGRAPHY

UNDERWATER RESEARCH ROBOTS TESTED IN BLACK SEA

Moscow PRAVDA in Russian 31 Oct 79 p 3

[Article by A. Androshin: "A Robot Walks on the Bottom"]

[Abstract] This article is a report on robots for underwater research. One of these is the "Manta-1500," a remotely controlled robot designed at the Institute of Oceanology USSR Academy of Sciences. It is said to be able to transmit information that it sees and hears under water. A test dive of the "Manta-1500" is described. It was carried to sea by a vessel that left its home base in Golubaya Bay on the Black Sea, where the institute's southern branch is located. The person in charge of the vessel was Nikolay Furs, chief mate of the research ship "Akvanavt." Furs set a course for deep water off Cape Bol'shoy Utrish. Discussing the experiment on the way, E. L. Onishchenko, head of the expedition, related that the number 1500 signifies the maximum depth at which the "Manta" is designed to operate. Onishchenko noted that the craft is equipped with a television scanning system, powerful lights, photocells and navigational and scientific instrumentation. It has a manipulator and a container for collecting soil samples from the sea floor. The robot is self-propelled, but it receives its power and is controlled from the surface through a cable connected to the carrier vessel. When the vessel reached its destination, Onishchenko operated the "Manta" for the first time at a depth of 700 meters.

The article also reports that this same group of researchers has another submersible research craft, the "Skat." Called a second-generation robot, it has not yet been under water. The "Skat" is equipped to function autonomously, with batteries as a power source. Its on-board computer receives commands by radio. Besides collecting rock, loose material, plankton, seaweed and small fish, the "Skat" will be able to perform certain repairs, for example, on underwater drilling rigs or telephone cables. It is noted that the Institute of Oceanology is now developing another "Manta," which will attempt to descend into craters of underwater volcanoes.

A photograph is given showing the "Manta-1500" in the water before a dive. [165-5303]

LOMONOSOV CURRENT IN THE FIELD OF OCEANOLOGICAL CHARACTERISTICS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 250, No 1, 1980 pp 197-199

[Article by V. S. Arsen'yev, A. B. Zubin, Corresponding Member USSR Academy of Sciences A. S. Monin and S. Ye. Navrotskaya, Institute of Oceanology and Atlantic Division Institute of Oceanology, "Lomonosov Current in the Field of Oceanological Characteristics"]

[Abstract] During March-April 1979 the "Akademik Kurchatov" investigated the equatorial subsurface countercurrent (Lomonosov Current) on two meridional sections across the equator: eastern ($18^{\circ}30'W$) and western ($23^{\circ}30'W$) between $2^{\circ}N$ and $2^{\circ}S$. Measurements of current direction and velocity were made over a period of 50 days using autonomous buoy stations spaced at a distance of 45 miles apart. During this period the Lomonosov Current was a powerful current with an easterly direction with velocities in its "core" up to $110 \text{ cm}\cdot\text{sec}^{-1}$. Its width in the axial region was 180-200 miles; the vertical thickness was 200-220 m. The current axis experienced quasi-periodic fluctuations in latitude and depth. Latitudinal fluctuations attained 30-40 miles; depth fluctuations were 20-30 m. The Lomonosov Current was clearly manifested in the fields of hydrological and hydrochemical properties. The hydrochemical characteristics of waters of the Lomonosov Current were established for the first time. One of the most interesting peculiarities of the current is the coincidence of its axis with the equatorial thermocline and pycnocline. This creates singular conditions for the distribution of temperature and density in the meridional sections (these are discussed in the paper). During the observation period the thermocline and pycnocline were situated between 30-40 and 100-110 m. In the region of the current axis the vertical gradients of temperature and density decrease sharply. A divergence of surface waters is observed above it. The divergence zone is the broader the closer the current rises to the surface. With emergence of the Lomonosov Current at the surface the width of the divergence zone attains 100-120 miles. The content of phosphorus and alkalinity in this current was determined for the first time. New data on dissolved oxygen and salinity are presented. Figures 2; references 6: 4 Russian, 2 Western.

[182-5303]

SEISMIC STUDIES ON "ACADEMY OF SCIENCES RISE" IN SEA OF OKHOTSK

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 250, No 4, 1980 pp 919-923

[Article by Corresponding Member USSR Academy of Sciences A. A. Geodekyan, Yu. P. Neprochnov, I. N. Yel'nikov, G. A. Yaroshevskaya, Institute of Oceanology and Institute of Physics of the Earth, "Results of Seismic Investigations on the 'Academy of Sciences Rise' in the Sea of Okhotsk"]

[Abstract] Comprehensive geological-geophysical and geochemical investigations were carried out on the 13th voyage of the "Dmitriy Mendeleev" (August-September 1974). This included observations by the seismic refracted waves method, work intended for the detection of the velocity parameters of the seismic section and structure of individual regions of the sea. In the neighborhood of the "Academy of Sciences Rise" a considerable amount of work was done by continuous seismic profiling. This made it possible to construct maps of relief of the surface of the acoustic basement in this region with an arbitrarily adopted mean velocity of propagation of seismic waves in the sediment layer equal to 2 km/sec. Seismic work by the refracted waves method in this region was undertaken for the purpose of determining the boundary velocity of elastic waves along the refracting surface of the acoustic basement and detecting its nature. In addition, the mean velocity of propagation of elastic waves in the sediment layer was determined for more precise estimation of depth of the acoustic basement. The refracted waves profile was oriented in a latitudinal direction on the southern slope of the Academy of Sciences Rise and approximately coincided with the isobath 1300 m. Three bottom seismographs were set out along the profile, approximately 13 km apart. The sources of seismic waves were pneumatic sound sources which were towed behind the ship at a speed of about 5 knots at a depth of 15-20 m, this ensuring the radiation of seismic waves in the frequency band 8-25 Hz. Radiation was at one-minute intervals, that is, each 150-170 m of the profile. The length of the profile with satisfactory records of seismic waves was 30-35 km. The wave pattern is described. The records made it possible to construct maps of the surface of the acoustic basement. There was a good coincidence of its depths and the depths of the refracting boundary with a velocity 5.3 km/sec. Dredging data obtained on this same expedition indicate that the basement consists here of a complex of rocks of an andesite formation, forming the Mesozoic folded basement of the sedimentary cover. Thus, the surface of the acoustic basement discovered by continuous seismic profiling corresponds to the top of the consolidated crust, at the same time being a good refracting boundary. Figures 3; references: 7 Russian. [217-5303]

RESEARCH SHIPS TO BE EQUIPPED WITH AUTOMATED NAVIGATION-GEOPHYSICAL COMPLEX

Moscow IZVESTIYA in Russian 23 Dec 79 p 6

[Article by T. Romanovskaya: "'MARS' Studies the Ocean"]

[Text] The scientific research ship "Issledovatel'" of the USSR Geology Ministry has returned to Gelendzhik from a four-month voyage. It has carried out multisided geological-geophysical studies in the central part of the Atlantic Ocean.

Such investigations have been carried out for the first time using the automated "MARS" navigation-geophysical complex. This complex was created by the scientists of the "Yuzhmorgeologiya" [Southern Seas Marine Geology] Combine of the USSR Geology Ministry and other organizations in collaboration with Hungarian specialists.

Geological reconnaissance work at sea requires adherence to highly complex technological conditions. The research vessel must move strictly along a stipulated route. Acoustic signals are sent from it into the sea depths. Reflected from the earth's crust, they are returned and are intercepted by sensors towed behind the ship. The on-board instrumentation registers and records them.

Until recently this process was not automated. Meteorological conditions and waves at sea -- all this led to a disruption of research technology. As a result, errors encumbered the collected data and these could be detected only with the interpretation of the data at on-shore computation centers. But it is usually distant to the shore. Much time elapses until it is possible to process the collected data.

"Our 'MARS'," states I. Glumov, one of its creators, the deputy general director of the "Yuzhmorgeologiya" Combine, "was developed on the basis of two electronic computers. Technologically it combines the on-board geophysical computation center, sensors for navigational-geodetic and geophysical information, an integral navigation system and system for automatic control of the ship in accordance with a stipulated program with the use of signals from satellites and navigation systems. It includes special devices ensuring safety for ichthyofauna. For the creation of this equipment

specialists and scientists were awarded the USSR State Prize for 1978. Due to operation of the complex the process of shipboard investigations has been completely automated and is carried out in an around-the-clock regime. The effectiveness from the introduction of only one "MARS" complex is more than a million rubles.

Now several scientific research ships of the USSR Geology Administration have been outfitted with the new instrumentation. In the coming year this instrumentation will be used in the seas and oceans.
[168-5303]

5303

CSO: 1865

II. TERRESTRIAL GEOPHYSICS

CHANGES IN GEOMAGNETIC FIELD AND SEISMICITY IN RESERVOIR AREA

Yerevan IZVESTIYA AKADEMII NAUK ARMYANSKOY SSR, NAUKI O ZEMLE in Russian
Vol 32, No 5, 1979 pp 72-79

[Article by S. R. Oganessian, A. N. Pushkov, A. Kh. Bagramyan and E. G. Geodakyan, Institute of Geophysics and Engineering Seismology Academy of Sciences Armenian SSR and Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Temporal Changes in the Geomagnetic Field and Seismicity in the Territory of 'Azat' Reservoir"]

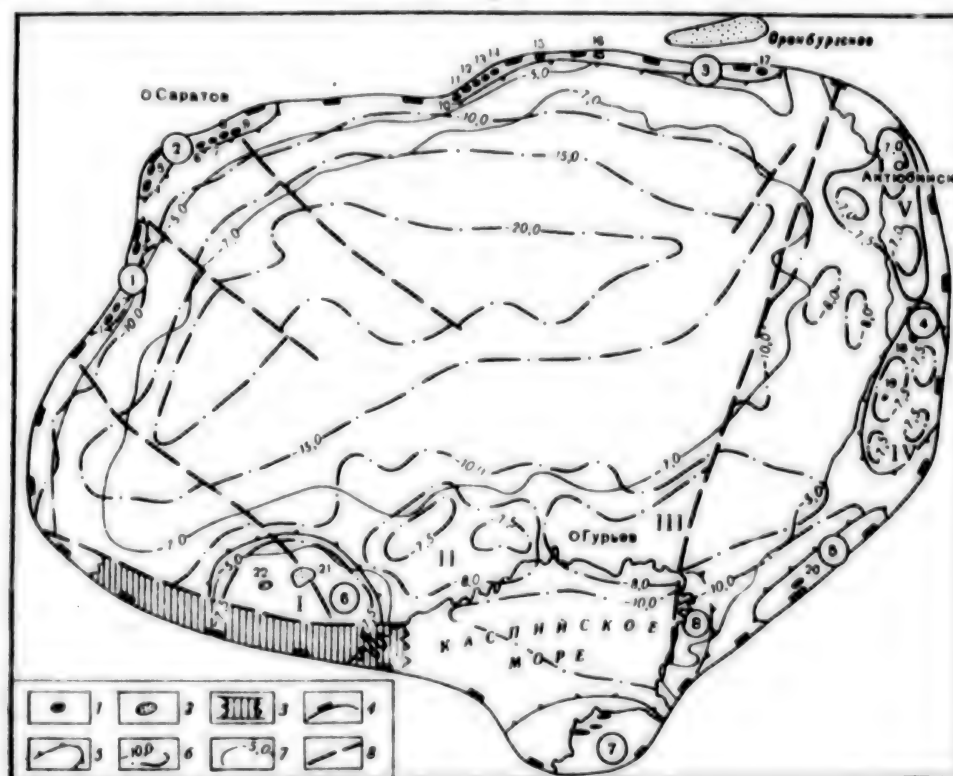
[Abstract] A local magnetic anomaly which is associated with accumulating mechanical stresses arising after filling with water was observed in the territory of the "Azat" reservoir. This phenomenon is of great significance because earthquakes have been known to develop during the filling of large reservoirs. Modeling of such magnetic processes was deemed important since plans call for the construction of 16 reservoirs in Armenia. Prior to construction of the "Azat" reservoir two profiles were run which intersected the most important sectors of the future water body. Magnetization and magnetic susceptibility were determined in rock samples of different types at pressures up to 800 kg/cm^2 . Measurements were made with an absolute magnetometer with a reading accuracy of 0.5 gamma. A total of 13 measurement cycles were carried out. The reservoir was filled twice, with level changes of 30 and 50 m. Seismicity was studied for the period from 1972 through 1974 for ascertaining the mean seismic background. The collected data revealed a correlation between the change in the geomagnetic field and the water level in the reservoir. The anomalies observed were associated with elastic curvature of layers of the earth's crust. With the onset of the first maximum of reservoir filling there was an increase in the number of microearthquakes with an insignificant increase in the quantity of energy released in the particular region. With the second filling of the reservoir to the level 50 m the number of microearthquakes dropped off. Figures 5; references 5: 3 Russian, 1 Western.
[194-5303]

PETROLEUM AND GAS IN SUBSALT DEPOSITS

Moscow IZVESTIYA AKADEMII NAUK SSSR, SERIYA GEOLOGICHESKAYA in Russian No 1, 1980 pp 135-144

[Article by Yu. A. Ivanov and L. G. Kiryukhin, All-Union Scientific Research Petroleum Geological Prospecting Institute, "Petroleum and Gas in the Subsalt Deposits of the Caspian and Central European Depressions"]

[Abstract] The article gives a thorough description of the structure, principal criteria of the presence of petroleum and gas and distribution of zones of petroleum and gas accumulation in the Central European and Caspian depressions. These zones are shown in the figure.



Deposits: 1) petroleum, 2) gas, gas condensate, petroleum-gas condensate, 3) Karakul'sko-Berkul'tinskaya zone of uplifts; boundaries: 4) Prikaspiyskaya petroleum and gas province, 5) zones of petroleum and gas accumulation; isohypses: 6) basement surface, 7) surfaces of subsalt deposits, 8) dislocations. Basement projections: I) Astrakhanskiy, II) Severo-Kaspiyskiy, III) Shukatskiy, IV) Zharkamyskiy, V) Yenbekskiy; zones of petroleum and gas accumulation (figures in circles): 1) Kamyshinsko-Lobodinskaya, 2) Rovensko-Mokrousovskaya, 3) Ural'skaya, 4) Kenkiyak-Karatobinskaya, 5) Yuzhno-Embenskaya, 6) Astrakhanskaya, 7) Severo-Buzachinskaya, 8) Primorskaya. Deposits of petroleum and gas in the subsalt complex: 1) Lobodinskoye, 2) Soldatovsko-Stepnovskoye, 3) Komsomol'skoye, 4) Limanskoye, 5)

Zapadno-Teplovskoye, 6) Kramakutskoye, 7) Zhdanovskoye, 8) Karpenskoye, 9) Bakramovskoye, 10) Tsyganovskoye, 11) Ul'yanovskoye, 12) Gremyachinskoye, 13) Vastuchino-Gremyachinskoye, 14) Zapadno-Teplovskoye, 15) Usovskoye, 16) Gorodinskoye, 17) Berdyanskoye, 18) Kenkiyaskoye, 19) Karatobinskoye, 20) Fortayskoye, 21) Astrakhanskoye, 22) Volozhkovskoye

The distribution of zones of petroleum and gas accumulation is associated with the presence of a thick salt-bearing cap in large paleouplifts of an ancient age and cosedimentation development. The distribution of petroleum and gas deposits in the section is associated with the lithological-facies composition of the rocks. In the subsalt section of the Caspian depression there are two groups of petroleum- and gas-bearing complexes: the first is associated with calcareous deposits developed within the limits of paleoshelves, whereas the second is associated with terrigenous series. The thickness of the subsalt section in the Caspian depression is twice as great as in the Central European depression. There is a greater contrast of depths of the Caspian depression, resulting in considerable regional slopes which accelerated migration processes and favored the concentration of hydrocarbons in marginal zones. There is a lower geothermal gradient of the subsalt deposits in the Caspian depression than in the Central European depression and there are superior conditions for the formation of both liquid and gaseous hydrocarbons. The subsalt complex of the Caspian depression is therefore far more favorable than the Central European depression for finding petroleum and gas. Figures 2. References 25: 20 Russian, 5 Western.

[188-5303]

INTERPRETATION OF MAGNETOVARIAION SOUNDING CURVES IN EASTERN ARCTIC

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 249, No 5, 1979 pp 1077-1078

[Article by N. V. Balgayenko, L. B. Volkomirskaya, V. I. Dmitriyev, N. M. Kozlova and G. A. Fonarev, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Interpretation of Magnetovariation Sounding Curves in the Eastern Part of the Arctic Ocean"]

[Abstract] Deep magnetotelluric and magnetovariation soundings have been carried out in several regions of the Arctic Ocean. This article reports on observations made in the neighborhood of Mendeleev Ridge. Local magnetovariation soundings were carried out at two points of the ridge with the coordinates $\varphi = 83^\circ$, $\lambda = 170^\circ$ and $\varphi = 84^\circ$, $\lambda = 230^\circ$. The descending branch of the ρ_T (apparent resistivity) curve was constructed in the interval of periods 6400-48 400 sec. Data on local magnetovariation soundings were supplemented by ρ_T values relating to regional and global magnetovariation soundings. If it is postulated that the earth is spherically homogeneous from depths of 400-500 km, any ρ_T curve from local or regional

sounding in sufficiently great periods should undergo transition into the global curve. (The desirability of joint interpretation of data from local and global soundings has been demonstrated before.) In the model used in this study solutions of direct problems were obtained for two types of sections -- gradient and layered. The gradient section was characterized by an increase in conductivity from depths $h = 200$ km which is greater than for a normal section. The layered section contained a layer with increased conductivity modeling the asthenosphere. The results of computations are presented in a figure. The main difference between the gradient and layered models is in the range of periods 10^5 - 10^6 sec. Since no experimental data are available for the studied region in this range, the question remains open as to the position of the point of transition of the regional curve into the global curve. However, it is possible to estimate the depth of the highly conducting horizon and the total longitudinal conductivity of the postulated asthenospheric layer (200 km and $4 \cdot 10^4$ cm respectively). Taking data from regional sounding into account, the total conductivity of the asthenospheric layer will be still greater. It can be concluded on the basis of this interpretation that the eastern part of the Arctic Ocean is characterized by a geoelectric section with low resistivity. Figures 1; references: 7 Russian.
[174-5303]

EQUATIONS FOR SURFACE LAYER OF PLANETS OF EARTH GROUP

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 249, No 5, 1979 pp 1082-1086

[Article by V. P. Myasnikov and A. V. Karakin, Moscow State University and Institute of Physics of the Earth, "Equations for the Surface Layer of Planets of the Earth Group in the Presence of an Asthenosphere"]

[Abstract] Earlier studies (V. P. Myasnikov, et al., DAN, Vol 237, No 5, 1977; V. P. Myasnikov, et al., DAN, Vol 238, No 5, 1978) gave the derivation of equations describing evolution of spherically symmetric components of geophysical fields and small asymmetric disturbances for planets of the earth group. In follow-up studies (V. P. Myasnikov, et al., DAN, Vol 239, No 4, 1978; V. P. Myasnikov, et al., DAN, Vol 249, No 4, 1979) the asymptotic expansions and multiscale chronological expansions methods were used in investigating the structure of movements in the surface layer of the planet in the absence of an asthenospheric layer. Now V. P. Myasnikov and A. V. Karakin, using this earlier work as a point of departure, have used the same methods but with the supposition that at the planetary surface there is a layer with reduced viscosity (asthenosphere). (The authors use the notations from the last of the above-mentioned articles.) In deriving the equations for this more complex model the authors consider the outermost part of the earth to consist of three layers

and analyze them separately (lowest layer I, transitional between the mantle and the asthenosphere; middle layer II, asthenosphere proper; upper layer III, lithosphere, with increased viscosity. Isostatic equilibrium and deviations from isostatic equilibrium are considered. Three hypotheses are considered relating to the composition of the mantle and asthenosphere. Finally, there is a discussion of the nature and origin of gravitational anomalies. References: 8 Russian.

[174-5303]

DENSITY-LITHOLOGICAL CHARACTERISTICS OF INTERSALT DEPOSITS

Minsk DOKLADY AKADEMII NAUK BSSR in Russian Vol 24, No 1, 1980 pp 63-66

[Article by A. P. Anpilov, V. Kh. Bulyga, V. A. Ksenofontov, I. I. Ur'yev, Geophysical Expedition of the Geology Administration Belorussian Council of Ministers and Institute of Geochemistry and Geophysics Belorussian Academy of Sciences, "Interrelationship of Density and Lithological Characteristics of Intersalt Deposits in the Pripyatskaya Depression"]

[Abstract] On the basis of a lithological study and regionalization of Lower Zadonian, Upper Zadonian and Elets'k deposits (Early Famennian) in the Pripyatskaya depression, taking into account the depths of these rocks, the authors have compiled a map of isodensities of the intersalt complex. It was found that there was a variable density over the area and a general correspondence between the configuration of the lines of equal density and the strike of the lithological fields and the principal geostructural elements. The map is reproduced in the text. The wide variation in density is governed by the composition of the deposits, the depth at which they occur, the influence of tectonic processes and other factors. The principal reason for the variation in density of the intersalt stratum is the lithological variability of the Zadonian-Elets'k deposits. There is a general correlation between the areal change in lithological and density characteristics. Due to the broad range of areal change in the mean density values of the intersalt complex, in the interpretation of the results of gravimetric studies in the Pripyatskaya depression it is impossible to use a constant density value; its variability must be fully taken into account in both regional and local studies. Figures 1; references: 9 Russian.

[172-5303]

USE AND REPLENISHMENT OF GROUND WATER SOURCES IN CRIMEA

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA, GEOLOGIYA-GEOGRAFIYA in Russian No 18, Vyp 3, 1979 pp 23-31

[Article by M. I. Vrublevskiy, Leningrad State University, "Use of Ground Water for Irrigation. Its Artificial Replenishment in the Steppe Crimea"]

[Abstract] The author points out that the use of ground water in the Crimean artesian basin for water supply and irrigation has led to a marked decrease in the levels of the most important aquifers in the Upper Neogene complex. Due to the inadequate natural moistening of the Crimean steppes and the heavy removal of water by wells the aquifers have been severely drawn down. It is therefore extremely important that measures be taken now to prevent their further exhaustion, to replenish these water-bearing horizons. An outline of the hydrogeological elements of the Crimean artesian basin is proposed. The very important role of the Crimean mountains in hydrogeological conditions is noted; it is very significant as an external source of water supply, for the formation of surface and underground runoff. The article, after reviewing this situation and the environmental factors involved, seeks to define a program for the artificial replenishment of the aquifers which have been subjected to this exhaustion. The use of high waters on rivers is proposed and accordingly data are given on the regimes of river systems. (The high-water discharge of some of these rivers greatly exceeds the low-water discharge.) Other proposals are made, and all are essential and quite urgent in order to satisfy the current and future needs of agriculture and industry in the steppe Crimea. Figures 1, tables 2; references: 16 Russian. [187-5303]

NEW METHOD FOR PETROLEUM AND GAS RECONNAISSANCE AND EXPLORATION

Kiev GEOFIZICHESKIY ZHURNAL in Russian No 1, 1980 pp 27-37

[Article by Yu. V. Timoshin, Kiev Geophysical Division, Ukrainian Scientific Research Geological Prospecting Institute, "New Method for Petroleum and Gas Reconnaissance and Exploration"]

[Abstract] The article gives a general review of the problems involved in the methods used in exploration and prediction of petroleum and gas deposits by geophysical methods and their place in the overall complex of geological reconnaissance investigations of petroleum and gas. On the basis of past and current practice, the author proposes a new method for petroleum and gas reconnaissance and exploration which includes the following generalized stages: regional prediction of the territory; exploratory local prediction of deposits of petroleum and gas over the entire

territory using an optimum complex of geophysical methods; detailed local prediction of petroleum and gas deposits in promising sectors; study of structure of the medium using geophysical data in the regions of predicted deposits; exploratory drilling of predicted deposits of petroleum and gas and "empty" structures. The proposed new method essentially differs from the standard method in that the object of reconnaissance and exploration from the very beginning in this case is the deposit itself and not the structure-trap with which the deposit is associated. Therefore, in the method it is the exploration and detailed prediction of petroleum and gas deposits which is of decisive importance and the method is identically suitable for the reconnaissance and exploration of deposits associated with traps of any type. In the case of regions with a sufficiently large number of anticlinal uplifts there is a variant of the new method which in contrast to the main variant can even now be employed on a practical basis. This variant can be used in the search for hydrocarbons associated with anticlinal structures. It involves four stages: regional prediction for the territory; reconnaissance and exploration of anticlinal structures and other objects by the seismic method; local detailed prediction of petroleum and gas deposits in the detected structures; exploratory drilling of structures with a positive and unsure prediction and structures with a negative prediction (as a control). As a result of introduction of these methods it can be expected that the success of field work will be approximately doubled. Figure 1; references: 7 Russian.

[211-5303]

BEHAVIOR OF PARAMETERS OF PRECURSORS OF IMPENDING EARTHQUAKES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 250, No 3, 1980 pp 599-601

[Article by A. Ya. Sidorin, Institute of Physics of the Earth, "Dependence of Anomalous Deformations of the Earth's Crust on Distance to the Epicenter of an Impending Earthquake"]

[Abstract] In the example of anomalous deformations of the earth's crust prior to earthquakes the author demonstrates that it is possible to investigate the dependence of the intensity of a precursor on distance to an earthquake epicenter on the basis of the totality of data relating to seismic events of different energy. The basis for such an analysis is the assumption that all earthquakes have a similar mechanism of preparation and only the magnitude of the effect changes proportionally to earthquake energy, whereas its dependence on distance remains constant. Data for the analysis were taken from earlier published studies. A total of 37 precursors were analyzed. The range of change in the amplitudes of deformations was from $1.6 \cdot 10^{-8}$ to $1.2 \cdot 10^{-5}$; the range of epicentral distances was from 3 km to 8600 km; earthquake magnitudes ranged from 3 to 8.6. In the analysis each precursor was represented in three-dimensional space in the

form of a point with the coordinates ($\lg \epsilon$, $\lg R$, $\lg E$), where ϵ is the absolute value of the relative deformation, R is the distance from a point of observation to the earthquake epicenter, E is earthquake energy. In the indicated space the data are grouped in the neighborhood of some plane. This makes it possible to propose the following dependence for describing precursors

$$\lg R \epsilon^m = aM - b,$$

where M is earthquake magnitude, m , a , b are constant coefficients. The following correlation dependence is also obtained:

$$\lg R \epsilon^{0.7} = 0.48M - 5.47$$

R is measured in kilometers. The above expression can be used in estimating the extent of the zone of anomalous deformations associated with the preparation of earthquakes. The dependence of the $\lg R \epsilon^{0.7}$ value for the analyzed precursors on earthquake magnitude is represented in Fig. 1. The approach developed in this paper makes it possible to determine the limits of the zone of detection of precursors for different measurement methods. The correlation dependence established in this study between earthquake magnitude, anomalous deformation and the epicentral distance at which it was observed can be useful for solving a number of practical problems related to earthquake prediction. Figures 2; references 7: 3 Russian, 4 Western.

[206-5303]

CHANGE IN SEISMICITY AS BASIS FOR ITS PREDICTION

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 9, 1979 pp 122-129

[Article by A. V. Chipizubov, Institute of the Earth's Crust, Siberian Department USSR Academy of Sciences, "Nature of Change in Seismicity as a Basis for its Prediction"]

[Abstract] A study was made of the nature of the course of seismicity and the interrelationship of crustal earthquakes of different intensity with time for the entire earth during the period of instrumental observations. The author found a cyclic nature of the seismic process with a period of 44-49 years (with a shift of the times series by 46 years the correlation coefficient $r = 0.54 \pm 0.12$) with a lengthening of the cycles by 14% and with a decrease in activity by a factor of 3 during the cycle or by a factor of 9 during 80 years. The article gives a long-range prediction of change in seismicity for the entire earth. It was established that the nature of the variation of the released energy of earthquakes with $M \geq 7.9$ after five years is reflected in the variation of energy released by earthquakes with $7 \leq M < 7.9$ ($r = 0.80 \pm 0.08$) and after 25-30 years with $6 \leq M < 7$. The law of frequency of recurrence is made specific. The conclusion

is drawn that it is impossible to use weak earthquakes for evaluating the frequency of occurrence of future strong earthquakes. The hypothesis of a unified system of stresses in the earth is confirmed. It is demonstrated that the nature of the change in seismicity for the entire earth in semi-secular values of its parameters can be applied to any seismically active regions. Figures 2; references 34: 32 Russian, 2 Western.
[221-5303]

PETROLEUM AND GAS IN EAST CASPIAN BURIED RISE

Moscow SOVETSKAYA GEOLOGIYA in Russian No 1, 1980 pp 28-34

[Article by N. Ya. Kunin, Institute of Physics of the Earth, B. A. Ogay, Aktyubinsk Geophysical Expedition and L. I. Ioganson, Institute of Physics of the Earth, "East Caspian Buried Rise and Prospects for Finding Petroleum and Gas"]

[Abstract] On the basis of an analysis of new geological and geophysical data it was possible to discriminate the extensive heterogeneous East Caspian rise, constituting a series of basement projections separated by transverse faults in the eastern marginal sector of the Caspian depression. The rise measures 320 x 50 km. As shown by Fig. 1, the rise is a sickle-shaped half-oval whose northern part has a northwesterly strike and whose southern part has a southwesterly strike. The axis of the rise in the central part comes close to the eastern margin of the depression, whereas the northern and southern margins of the rise are 90-100 km from it. The surface of the basement in the most uplifted parts of the East Caspian rise is traced at depths of 7-8 km, whereas in adjacent depressions -- at depths of 9-11 km, that is, there is considerable contrast in the basement relief. A table gives the principal characteristics of individual structures in the rise. The data presented in this paper made it possible to evaluate the prospects for finding petroleum and gas in the subsalt complex. The tectonic position of the buried rise, surrounded by regions of prolonged downwarping in which thick, continuous marine deposits were accumulated, has led to conditions favorable for the generation of hydrocarbons and the occurrence of lateral migration. The prolonged development of the buried rise as a zone of lesser sedimentation in comparison with the adjacent regions has the following favorable consequences: relatively improved collector properties and absence of continental erosion, a factor exerting a negative effect on conditions for preservation of deposits. The Temirskiy block has the most favorable position. Therefore, an intensification of reconnaissance work in the structures of this block is recommended. Figures 2, tables 1; references: 6 Russian.
[210-5303]

ATMOSPHERIC EFFECT ON RESULTS OF MERCURY ATMOSPHERIC CHEMICAL SURVEY

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA, GEOLOGIYA-GEOGRAFIYA in Russian No 18, Vyp 3, 1979 pp 42-47

[Article by E. L. Al'tman, T. V. Dreval', G. B. Sveshnikov, Yu. I. Turkin, S. Ye. Sholupov, Leningrad State University, "Atmospheric Effect on Results of Mercury Atmospheric Survey"]

[Abstract] At Leningrad State University specialists are developing an atmochemical method using direct atomic-absorption determinations of mercury vapor directly in atmospheric air. The instrumentation consists of two autonomous units: source and detector, which can be situated at a distance of 10 to 100 m from one another. The most informative parameter is the strength of the photocurrent, dependent on the absorption of the resonance radiation of mercury ($\lambda = 254$ nm) in the analyzed space. An anomaly is discriminated relative to some background level. In this paper the authors give an evaluation of the limits of variations of the background attributable to the influence of atmospheric interference. These evaluated factors are: 1) molecular scattering -- scattering on air density fluctuations; 2) signal changes introduced by atmospheric turbulence; 3) aerosol influence; 4) ozone influence. Under field conditions the measurements are usually made on profiles with a length of 300-1000 m with a distance of 20 m between the source and detector at a height of about 1 m above the ground. The instrument time constant is ± 5 sec and the average duration of measurements is 15 sec. According to the estimates cited in this article, it is possible to neglect the influence of such atmospheric factors as molecular scattering and atmospheric turbulence; the influence of aerosol and especially ozone can be considerable under definite weather conditions. Measurement accuracy can be increased by using a single-ray analyzer by repeated passages along the profile in the anomalous zone or by employing a two-wavelength analyzer constructed on the basis of the Zeeman effect. Figures 4; references 16: 14 Russian, 2 Western.

[187-5303]

PRESENCE OF PETROLEUM AND GAS IN SOUTHERN UKRAINE

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR, SERIYA B, GEOLOGICHESKIYE, KHIMICHESKIYE I BIOLOGICHESKIYE NAUKI in Russian No 1, 1980 pp 6-11

[Article by Academician Ukrainian Academy of Sciences G. N. Dolenko, A. I. Parylyak, O. Stupka and I. P. Kopach, Institute of Geology and Geochemistry of Mineral Fuels Ukrainian Academy of Sciences, "The Problem of the Presence of Petroleum and Gas in the Southern Ukraine"]

[Abstract] During recent years much work has been done in exploring the petroleum and gas reserves of the southern Ukraine. Whereas in 1946 exploratory wells were drilled to an average of 800 m, now the depth has attained 5000 m. The principal objects being investigated are Miocene, Maykop, Paleocene and Cretaceous rocks. About 30 deposits have now been detected (the text is accompanied by a full-page map of petroleum and gas deposits in the area). The hydrocarbon reserves have the following distribution: Maykop -- 51.9%, 21.6% -- Paleocene, 11.2% -- Lower Cretaceous, 7.5% -- Neogene, 3.3% -- Upper Cretaceous. The region has the geological prerequisites for the existence of more than 308 structures and traps of anticlinal and nonanticlinal types. Assuming that the coefficient of success in geological prospecting work is 0.3, it can be hoped that up to 92 deposits can be discovered, primarily gas and gas condensate deposits (4 of average size, 12 small and 76 quite small). Nevertheless, the success of work in the southern part of the Ukrainian SSR remains low; the reasons for this are discussed. Tectonic regionalization of the territory on a sounder basis is required. Deposits must be sought in the largest anticlinal uplifts of the Sea of Azov and on the shelf zones of the Black Sea. Figures 1; references: 9 Russian.
[213-5303]

MAPPING OF SUBSALT CALCAREOUS STRATUM IN CASPIAN DEPRESSION

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 10, 1979 pp 11-17

[Article by V. L. Sokolov, Yu. B. Silant'yev and M. O. Khvilevitskiy, All-Union Scientific Research Institute of the Gas Industry, "Increasing the Effectiveness of Mapping of the Subsalt Calcareous Stratum in the Eastern Part of the Caspian Depression"]

[Abstract] In the eastern part of the Caspian depression in the subsalt rocks of the Paleozoic it is easy to discriminate three major complexes of sedimentary strata differing with respect to the conditions and prospects for discovery of petroleum and gas. These three complexes are discussed in detail. Most of the gas and petroleum resources are associated with the calcareous complex. In order to determine the structure of this

complex more precisely it will be necessary to have an increased density of the network of reconnaissance soundings by the common shot point method, increasing the density to one sounding each 150-200 km². When preparing the areas for exploratory drilling it is necessary to increase the density of soundings to one each 20-40 km² and process the collected velocity information for predicting the mineralogical composition of the subsalt complex. Seismic logging and vertical seismic profiling must be carried out in all deep boreholes. Figures 3; references: 12 Russian. [122-5303]

KINEMATICS OF TECTONIC MOVEMENTS AND DENSITY OF EARTHQUAKE EPICENTERS

Moscow IZVESTIYA VUZov, GEOLOGIYA I RAZVEDKA in Russian No 12, 1979 pp 24-28

[Article by O. A. Voyeykova, Moscow State University, "Quantitative Evaluation of the Correlation Between the Kinematics of the Most Recent Tectonic Movements and the Distribution of the Density of Earthquake Epicenters (in the Example of Central Asia)"]

[Abstract] The author has endeavored to refine the relationship between the kinematics of the most recent tectonic movements, which can be quantitatively represented by their amplitude, mean velocity gradient, and also tectonic activity, with zones characterized by a different density of earthquake epicenters. In constructing maps of the mean gradient of the rate of movement and tectonic activity at a scale of 1:1,000,000 for Central Asia use was made of the map of the "Most Recent Tectonic Movements in the Southern USSR," published in 1971. Seismic characteristics were taken from the publications "USSR Earthquakes." The evaluation of the influence of different indices of the kinematics of the most recent tectonic movements on the distribution of zones with different density of epicenters of weak and strong earthquakes indicated that the correlation of these parameters with a very high degree of probability can be considered reliable. The influence of the kinematics of neotectonic movements on the peculiarities of localization of earthquake epicenters is small (mean values about 3-10%) and in individual sectors attains 25%. An analysis of the empirical regression lines indicated a complex dependence between the principal characteristics of the kinematics of the most recent tectonic movements and the investigated seismicity parameter. This dependence varies with transition from zones with a low density to zones with a considerable density of epicenters of both weak and strong earthquakes. The use of statistical data on the density of epicenters of weak earthquakes is ineffective for evaluating the places of concentration of strong earthquakes. Use of the dispersion analysis method in seismotectonic investigations is promising. Figures 1, tables 1; references: 8 Russian. [186-5303]

SWARMS OF WEAK EARTHQUAKES AND PREDICTION OF STRONG EVENTS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 1, 1980
pp 21-33

[Article by Yu. M. Teytel'baum and V. S. Ponomarev, Institute of Physics of the Earth, "Swarms of Weak Earthquakes in the Prediction of Strong Events"]

[Abstract] The temporal change in variations of weak earthquakes ($K = 7-8$) in the near-focal regions of 26 earthquakes with $K \geq 12$ was investigated using data from seismological observations in the Garm polygon in the Tadzhik SSR during the period 1955-1976. Figure 1 is a map of seismicity of the Garm region; Table 1 is a list of earthquakes in the Garm region for the pertinent period. The following subjects are covered: precursory activation in near-focal zones of main tremors; spatial distribution of weak earthquakes; influence of strong earthquakes on the form of a time series of activity of weak earthquakes; localization of site in prediction of strong earthquakes. There is a stable effect of the appearance of swarms of weak earthquakes (about 77% of the cases) preceding the main tremor by 1 1/2 years or less. The discrimination of precursory swarms in an area of seismic calm makes it possible to localize the sites of predicted earthquakes with an accuracy approximately equal to the extent of the focal area. The influence of consolidation of the medium on the time interval between the maximum of the precursory swarm and the development of the main tremor is discussed. Figures 8, tables 1; references 16: 12 Russian, 4 Western. [222-5303]

FOCAL MECHANISM OF WEAK EARTHQUAKES UNDER INFLUENCE OF RESERVOIR FILLING

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 1, 1980
pp 34-42

[Article by O. V. Soboleva, Institute of Seismic Resistant Construction and Seismology, Tadzhik Academy of Sciences, "Change in Focal Mechanisms of Weak Earthquakes Under the Influence of the Nurekskoye Reservoir"]

[Abstract] The Nurekskoye Reservoir is situated in the middle part of the Vakhsh River basin in the northern part of the Tadzhik depression. The filling of the reservoir began in 1967 but the water level was low and only in a few months in 1971 did it reach 60 m. The first stage of intensive filling to the level 110 m began in late 1972 and the second stage, to the level 210 m, began late in 1976. After the water level had risen there was a marked increase in the number of earthquakes near the reservoir. During 1972-1973 the number of earthquakes with $K \geq 7$ increased by a factor of approximately 6, and in 1976 by a factor of 8 in comparison with

the mean level during the preceding 12 years. The purpose of this study was a detailed investigation of changes in focal mechanisms coinciding in time with the period of filling of the reservoir, determination of the causal relationship of these phenomena and discrimination of the zones where the influence of the reservoir was best manifested. The author investigated the focal mechanisms of 270 earthquakes with $K = 9-12$ in the area during the years 1960-1976. There was a change in the predominant orientation of the compressional axes in focal areas situated to the southwest and northeast of the part of the reservoir with the deepest water after its filling. There was an increase in the relative number of earthquakes with a northwesterly orientation of the discontinuities cutting the mapped geological dislocations. The observed changes in orientation of the focal mechanism are attributable to additional stresses from the weight of the water and elastic downwarping of the reservoir floor.
[222-5303]

CALCAREOUS COMPLEXES OF SUBSALT DEPOSITS IN EASTERN CASPIAN DEPRESSION

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 10, 1979 pp 47-54

[Article by N. Ya. Kunin, L. I. Ioganson, N. V. Miletenko, B. A. Ogay and V. G. Chistyakov, "Zonality of Development of Calcareous Complexes of Subsalt Deposits in the Eastern Marginal Part of the Caspian Depression"]

[Abstract] Zones of development of calcareous subsalt deposits have been discovered in the eastern marginal part of the Caspian Depression. A comprehensive analysis of the results of drilling and seismic exploration by the reflected waves method, common deep-point method and refracted waves method in this area made it possible to define the outlines of individual calcareous sedimentation bodies and describe the specific patterns of their distribution not characteristic of the northern and western margins of the depression. In the mapping of the subsalt calcareous complexes use was made of the nature of the wave field of the reflected waves. This was very important because in contrast to discrete drilling data and individual profiles run by the refracted waves method the reflected wave data and data obtained by the common deep-point method were obtained using a relatively dense network of profiles. On the basis of the characteristics of the wave field of reflected waves it was possible to discriminate several zones differing in structure. These 10 zones are described in detail. Within the limits of the considered area it is possible to discriminate a number of downwarps and projections on the basement surface. These are analyzed in relation to the enumerated seismogeological zones. There is a rather clear relationship between major tectonic elements of the basement surface and the peculiarities of the internal structure of the subsalt complex. The calcareous strata are associated with the uplifted elements, usually coinciding with basement projections. Noncalcareous zones are associated with

downwarps. The investigations reported in this paper are of great importance in selecting the direction for future reconnaissance and exploration work. Figures 3, tables 1; references: 10 Russian.
[122-5303]

PALINSPASTIC METHOD FOR DETERMINING POSITION OF DEEPLY BURIED STRUCTURES

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 10, 1979 pp 54-58

[Article by Yu. A. Sterlenko and I. V. Istratov, Groznyy Petroleum Institute, "Palinspastic Method for Determining the Position of Deeply Buried Structures"]

[Abstract] The patterns of structure of deeply buried folded forms of the earth's crust is very important in petroleum and gas geology. This article describes a palinspastic method for determining the position of arches of buried structures under conditions of broad development of dislocations. On the basis of the presented palinspastic analysis and geophysical data it was possible to determine the position of the Middle Jurassic rise in one of the western sectors of the Tersko-Sunzhenskaya Oblast. The described method can be used extensively in predicting structural traps by means of a study of the history of their formation under conditions of disharmonic folding. It can be postulated that Jurassic structures, in comparison with Cretaceous structures, will be displaced relative to the Cretaceous formations by 5-10 km to the south. This circumstance must without fail be taken into account in reconnaissance and exploration work. Taking into account that the thick (about 300 m) gypsum-salt stratum can serve as a reliable cap, it is possible to postulate that the subsalt complexes of the Jurassic in the studied region contain primarily gas condensate and gas deposits. Figures 2; references: 4 Russian.
[122-5303]

III. PHYSICS OF THE ATMOSPHERE

IR ABSORPTION SPECTRA OF AEROSOL SAMPLES OVER OCEAN

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 250, No 3, 1980 pp 596-598

[Article by Yu. S. Lyubovtseva and V. M. Pavlov, Institute of Atmospheric Physics, "Infrared Absorption Spectra of Aerosol Samples Over the Ocean"]

[Abstract] This paper gives IR absorption spectra of samples of atmospheric aerosol collected over the ocean using a cascade impactor with a CaF_2 plate. The samples were taken in the spring of 1978 in the tropical zone of the Pacific and Atlantic Oceans along the track of the "Dmitriy Mendeleev." The transmission spectra of aerosol samples were measured in the range $2.5\text{--}12\mu\text{m}$. Some of the samples were taken in the tropical part of the Pacific Ocean in a geographic region remote from the continental shore and from large populated islands; they can be regarded as purely oceanic. Other samples were taken over the ocean in the neighborhood of densely populated shores with well-developed industry where the influence of the continent and anthropogenic sources of contamination on marine aerosol should be great. For the first time it was possible to evaluate the role of different fractions of oceanic aerosol in general aerosol attenuation. A fractional analysis of samples in the range of particle sizes from 0.2 to $5\mu\text{m}$ in radius indicated that particles with a radius $a \leq 0.9\text{--}1.5\mu\text{m}$ virtually do not participate in the attenuation of light in the spectral region $2\text{--}12\mu\text{m}$. There is a fundamental difference in the volumetric distribution of marine and continental aerosols. The assumption of a decisive role of the mechanism of formation of salt particles in the total mass of particles over the ocean is confirmed. Under the influence of the continent with well-developed industry secondary sources of aerosol begin to play an important role. For purely oceanic samples the intensity of the NaCl absorption bands increases with an increase in the height of ocean waves. In the absorption spectra of samples collected over the ocean near shores with well-developed industry there are no NaCl bands. The composition of organic compounds can vary considerably in different parts of the ocean. With approach to the continent there is a considerable change in the molecular composition of oceanic aerosol and the nature of the IR absorption spectrum. Figures 1; references 9: 6 Russian, 3 Western. [206-5303]

ACOUSTIC-GRAVITATIONAL WAVES IN HIGH-LATITUDE ATMOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 20, No 1, 1980 pp 72-76

[Article by L. M. Alekseyeva, A. V. Getling and B. V. Magnitskiy, Institute of Nuclear Physics, Moscow State University, "Standing Acoustic-Gravitational Waves in the High-Latitude Atmosphere With Allowance for the Earth's Rotation"]

[Abstract] In earlier studies (GEOMAGNETIZM I AERONOMIYA, 17, 756, 1977; DOKLADY AN SSSR, 240, 1328, 1978; GEOMAGNETIZM I AERONOMIYA, 18, 1063, 1978) it was demonstrated that variations in ionospheric pressure can cause standing acoustic-gravitational waves (SAGW) in the lower-lying atmosphere. The conclusions drawn in those studies, all by the author of this new paper, relate to quite short-period processes in whose examination the earth's daily rotation can be neglected. The investigation is continued here for the purpose of clarifying the possible meteorological consequences of auroral processes, investigating the longest-period SAGW and taking into account the effect of Coriolis force. In the formulation of the problem only the high-latitude atmosphere is considered and curvature of the earth's surface is neglected. Two possible sources of SAGW are considered: source I, associated with uniform heating of the auroral oval, and source II, caused by heating during the leakage of particles near the contact between the westerly and easterly electrojets. During periods of great magnetic activity substorms follow one another with a period of about three hours and therefore SAGW of these same periods should be excited. This property of weakening of long-period SAGW during periods of maximum magnetic activity must be remembered when discussing possible meteorological effects because at times the correlation between meteorological data and geomagnetic activity is improved if such periods are excluded from consideration. References 11: 5 Russian, 6 Western. [216-5303]

GROUND STUDIES OF IONOSPHERE IN REGION OF MAIN GAP

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 20, No 1, 1980 pp 39-44

[Article by Ye. F. Kozlov and N. I. Samorokin, Institute of Space Physics Research and Aeronomy, Yakutsk Affiliate Siberian Department USSR Academy of Sciences, "Ground Investigations of Ionosphere in the Region of the Main Gap"]

[Abstract] The article discusses ground investigations for determining the temporal and spatial evolution of ionospheric parameters in the region of the main gap. The work was done in the Arkhangel'sk polygon during 1971-1972 with vertical sounding of the ionosphere in one longitude sector at three stations — Mezen' ($L = 4.39$), Arkhangel'sk ($L = 4.09$) and Karpogory

($L = 3.92$). Emphasis is on two problems most characteristic for the subauroral zone: anomalous ionization in the F2 region, caused by the injection of electrons with an energy of tenths of keV and a decrease in ionization density with approach to the gap zone. It was found that under magnetically quiet conditions ($K_p = 0-1$) the gap separating the middle-latitude and polar ionosphere in the longitude sector of Arkhangel'skaya Oblast is situated to the north of Mezen' and at all three stations there are reflections from the normal F2 layer with f_0F2 values decreasing with an increase in latitude. Under moderately disturbed conditions ($K_p \leq 4$) the additional reflections which are observed in the F region when $f > f_0F2$ constitute slant reflections from a reflecting structure -- the polar wall of the ionospheric gap -- common for all three stations. The position of the wall is dependent on the activity level and local time. Vertical sounding in a chain of stations in the subauroral zone under conditions of weak and moderate activity makes it possible during the nighttime hours to carry out virtually continuous observation of movements of the gap and the southern boundary of anomalous ionization. Such observations are a convenient tool for the diagnosis of magnetospheric structure and its dynamics and also are of more than a little importance in predicting radio wave propagation on subauroral paths. The stations should be situated about 100 km apart. Figures 2; references 9: 7 Russian, 2 Western.
[216-5303]

CORRELATION BETWEEN SLANT SOUNDING SIGNAL FADING AND GEOMAGNETIC PULSATIONS

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 20, No 1, 1980 pp 49-51

[Article by V. V. Kazantseva, V. A. Luganin and M. G. Savin, Northeastern Multidiscipline Institute and Institute of Tectonics and Geophysics, Far Eastern Scientific Center, "Correlation Between Fading of a Slant Sounding Decimeter Signal and the H Component of the Field of Geomagnetic Pulsations"]

[Abstract] An attempt is made at explaining the generation of ionospheric inhomogeneities, causing the fading of a slant sounding signal, by magnetohydrodynamic waves responsible for long-period geomagnetic pulsations of the Pc 4, 5 type. The study is based on an analysis of data from short-pulse ($\tau' \approx 100 \mu\text{sec}$) slant sounding on the path Pevek-Magadan in 1973 and synchronous records of long-period geomagnetic pulsations on variometers of the IZMIRAN-4 series at Magadan. These experimental data were used in computing the cross-correlation coefficients for both synchronously transpiring processes. The existence of a causal relationship between the two processes could be evidence of continuous excitation of ionospheric inhomogeneities -- waves with random phases in some spatial range -- by MHD waves. It can be postulated that in the case of complex nonlinear transformation of MHD waves into acoustic and gravitational waves, which in

principle are capable of generating inhomogeneities, the latter arrive in the region of space sounded from the earth with different amplitudes and phases, from different trajectories, and therefore, different delays. A preliminary analysis of the synchronous processes of fading of a decameter slant sounding signal and the H component of the field of long-period geomagnetic pulsations indicated that both processes are characterized by a similarity of the spectral characteristics and correlate rather well. Tables 1; references 3; 2 Russian, 1 Western.
[216-5303]

CONDITIONS FOR SUPERDISTANT PROPAGATION OF SHORT RADIO WAVES

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 20, No 1, 1980 pp 151-153

[Article by S. F. Golyan, V. A. Panchenko and A. G. Shlionskiy, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Correlation Between Conditions for Superdistant Propagation of Short Radio Waves and Magnetic Activity"]

[Abstract] Ionospheric-magnetic disturbances exert a substantial influence on the conditions for propagation of short radio waves. When investigating this correlation on superdistant paths it is best to use the statistical research method. Such a statistical analysis was made using data from long-term measurements on the radio link Moscow-Molodezhnaya. The path had a meridional direction with a length 13 700 km. Sounding in a pulsed regime was carried out at 10 fixed frequencies each 3 hours. The amplitude of the signals and their relative delays were registered. In addition to direct signals (DS), there were return signals travelling along a great circle (RS) and around-the-world signals (AWS) and signals travelling twice around the earth. The equinoctial periods 1967 and 1972 were selected for determining the statistical correlation of the parameters of the superdistant signals and the K_p index. On magnetically quiet days in 1967 the probability of reception of AWS was equal to unity. There is a marked decrease in the probability of reception of AWS with an increase in K_p. Signals travelling twice around the world were observed rarely and only on magnetically quiet days. The probability of detecting RS is slightly dependent on magnetic activity. For the direct path the correlation of propagation conditions and magnetic disturbances is poorer than for the AWS and RS. With an increase in magnetic activity the conditions for superdistant propagation of short radio waves worsen (decrease in amplitude, decrease in maximum usable frequency and increase in minimum usable frequency). The influence of magnetic activity is intensified with an increase in path length and length of the sector of passage through auroral regions. Figures 2; references 10; 7 Russian, 3 Western.
[216-5303]

IV. ARCTIC AND ANTARCTIC RESEARCH

25TH SOVIET ANTARCTIC EXPEDITION BEGINS WORK

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 19 Dec 79 p 4

[Interview with P. K. Sin'ko, Senior Specialist Arctic and Antarctic Scientific Research Institute, Candidate of Geographical Sciences: "In the Antarctic It's Summer"]

[Excerpt] The participants in the 25th Soviet Antarctic Expedition are continuing their work at the six permanently operating stations. In addition, the seasonal stations "Komsomol'skaya" and "Druzhnaya" have again been opened. An auxiliary airdrome will be constructed at the first of these; this will ensure regular communication between "Mirnyy" and "Vostok" stations. Finally, a group of researchers is attempting to make its way to the Antarctic region most complex with respect to ice conditions -- the shores of the Amundsen Sea. The first permanently operating station in this area, "Russkaya," will be established here. Initially its personnel will consist of only nine persons -- for the most part meteorologists and glaciologists.

At this time a large detachment of geophysicists and geologists will continue their work on the ice continent. Their task is to carry out a survey and to investigate the rocks in the mountains at "Druzhnaya" station. However, the work of the scientists, as usual, is not limited to the regions around the stations. In order to broaden the "geography" of the observations plans call for undertaking a trek in "Khar'kovchanka" cross-country vehicles from "Mirnyy" to so-called "Dome C." The extent of this route is more than 3,500 km. During the trek investigations will be made under the program of the International Glaciological Antarctic Project, in whose implementation the scientists of many countries will participate. Glaciologists are continuing the drilling of a deep borehole in the ice at "Pionerskaya" station.

At present some of the participants on this expedition are still en route -- aboard the scientific-expeditionary ship "Mikhail Somov" and the diesel electric ship "Gizhiga." The last ship for Antarctica, the steamer "Estoniya," is making ready for departure. Soon the entire expedition will be together. By tradition our foreign colleagues -- geologists and geophysicists from East Germany and the United States -- are taking part in its work. The polar specialists of the 25th Soviet Antarctic Expedition are faced

with interesting investigations, which, we hope, will multiply our knowledge not only about the sixth continent, but also about our planet as a whole.

[169-5303]

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RELAXATION PROCESSES IN ARCTIC ICE FIELDS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 250, No 3, 1980 pp 589-592

[Article by Corresponding Member USSR Academy of Sciences V. V. Bogorodskiy and V. N. Smirnov, Arctic and Antarctic Scientific Research Institute, "Relaxation Processes in Arctic Ice Fields"]

[Abstract] A mechanism of the interaction of ice fields and the accompanying effect of mechanical relaxation oscillations are considered. These oscillations have been studied in areas of drifting of the "Severnnyy Polyus" drifting stations. The method used was the triple seismic station, making it possible to measure deformation processes on a base up to 5 km in length. Among the instruments used were short-period seismic detectors, seismic tiltmeters, and pressure sensors in the ice. Over a 10-month period 150 wave processes were registered, mostly in the winter months. The processes are accompanied by elastico-plastic compressional and dilatational deformations of continuous ice fields. The dimensions of the focus attain several kilometers. The processes usually consist of alternating trains of deformations. In one train there can be up to 50 oscillations of a sawtooth form. The period of oscillations in a train is 10-25 sec. The amplitude of the first pulse in the train is always greater than the amplitude of the succeeding pulses. The duration of the leading edge of the first pulse is 0.5-4 sec. The oscillations are stable in amplitude, period and direction to the source during the entire time of existence of the process. Each peak in the train of oscillations corresponds to horizontally polarized. Each peak in the train of oscillations is accompanied by horizontally polarized, primarily transverse waves. All these characteristics indicate that mechanical relaxation oscillations arise under definite conditions in continuous ice fields. The mechanism of the described phenomenon is very similar to processes in the focus of a tectonic earthquake. The processes in ice fields may be applicable in the modeling of seismological processes. Figures 3; references 9: 8 Russian, 1 Western.

[206-5303]

PREPARATIONS FOR 25TH ANTARCTIC EXPEDITION CONTINUE

Moscow PRAVDA in Russian 30 Jan 80 p 6

[Article by Ye. Tolstikov, Deputy Chairman of the USSR State Committee on Hydrometeorology and Environmental Monitoring: "On Course to the Antarctic"]

[Excerpts] The steamer "Estoniya" with polar specialists aboard has left from Riga as a ship of the Soviet Antarctic Expedition. This is the last party of specialists who are being sent to replace the polar workers of the 24th expedition, who are completing their work. The steamer "Bashkiriya" has already arrived in Antarctica, delivering there the first group of participants of the 25th Soviet Antarctic Expedition. The people they are replacing are now half-way from the sixth continent to the motherland. The "Bashkiriya" is bringing back the polar workers who have already spent their year in Antarctica. Our flagship, the diesel-electric "Mikhail Somov," has delivered seasonal specialists to "Druzhnaya" on the shores of the Weddell Sea and now is heading for "Mirnyy." There two steamers of the expedition are already being unloaded. The ship "Professor Vize" is carrying out scientific work in the Antarctic Ocean.

However, the ice continent is still keeping many secrets and exploration must continue. The scale of this work is evidenced by the program of the 25th Soviet expedition. In connection with an accident to a ship heading for the ice continent its program had to be seriously replanned. Now it includes work in the fields of geophysics, glaciology, oceanography, hydrometeorology and hydrography. The scientific work includes the most different fields: medicine, aerology, study of auroras, environmental contamination. Observations will be continued in the fields of cosmic rays, seismicity and ozonometry. The specialists will be assisted by artificial earth satellites, rockets, radars. Much attention will be devoted to the computer processing of observational data.

A total of 188 men will spent the winter at the seven Soviet stations. This includes ten representatives of other countries. Six scientific research ships will participate in the expedition.

As is well known, it takes a month to get to Antarctica by sea, or even more. That is why long ago we made preparations for organizing aircraft communication with the distant continent. The studies of planners of the Civil Aviation Ministry revealed that it is possible to pack down the snow cover to such a state that it will hold an IL-18 aircraft. Now such a landing strip has been created at Molodezhnaya and there is a natural reserve airdrome on the ice in the neighborhood of Novolazarevskaya. During the mid-February period plans call for a test flight of an IL-18 aircraft across East Africa with a stop at Maputo. From there the air liner will take course for Molodezhnaya. If this flight proves itself it will greatly improve the effectiveness of the expedition's work and it will be more reasonable to use personnel in summer for investigations in Antarctica.

The next expedition will begin after the tenth consultative conference of the adherents to the Antarctic treaty. We polar researchers are satisfied that the friendly relationships among the scientists of different countries on the sixth continent favored the appearance of what in my opinion is a very good treaty which regulates the interrelationships of countries interested in the study and habitation of Antarctica in social and political respects. The treaty provides for equal rights of countries in carrying out research.

The consolidation of this position is favored by the consultative conferences of the participating countries. These are usually held in a spirit of mutual understanding in a search for mutually acceptable decisions. As a result, important recommendations have been adopted on the preservation of historic monuments; on tourism, on telecommunications, on the preservation of the flora and fauna of Antarctica, on free access to scientific data, on the exchange of information among countries, on the numbers and fields of specialization of personnel, on scientific equipment, transportation facilities, etc. All the recommendations adopted at the conferences are approved by the governments of the corresponding countries.

In a relatively short time scientists have been able to study Antarctica and outline the prospects for its economic mastery. This is the chief result of the joint efforts of scientists of different countries.

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INTERPRETATION OF RADAR SIGNALS FROM ARCTIC SHORELINES

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA, GEOLOGIYA-GEOGRAFIYA in Russian No 24, Vyp 4, 1979 pp 66-73

[Article by A. A. Kotyukh, Leningrad State University, "General Methodological Aspects of Interpretation of Radar Signals (in the Example of the Shorelines of Arctic Seas)"]

[Abstract] The article deals with methods for the visual interpretation of echo signals on the screens of navigational radar stations. Emphasis is on the details of analysis of the radar pattern on the radar screen, taking into account the "fogging" influence of all kinds of external factors and the specific characteristics of image distortion following from the technical principles of radar operation. The purpose of this introductory examination is to lay a background for defining the nature of the radar reflections which are observed during surveys of the different types of shorelines characteristic of arctic seas. With respect to the vertical profile, shores can be classified into the following groups: a) steep shores of different height, dropping off vertically to the water; b) shores with a flat or slightly hilly "foot," situated in front of a steep shore ledge; c) shores with a broad beach adjacent to a high scarp; d) flat, uniform lowland shores; e) different kinds of glacial shores. The most intense reflection of radio waves in the centimeter range is from shorelines of the first two types and the least intense is from the others. If shorelines were classified as "abrasional" and "accumulative," it is the first which could be detected more reliably from the greatest distances. The following classification of arctic shorelines is proposed. 1. Novozemel'skiy type. These shorelines have a high reflectivity. They are of abrasional origin and consist of metamorphic granites and basalts. 2. Dikonskiy type. Detectable by radar from distances 20-40% less than for the Novozemel'skiy type. They consist of basaltic, granitic or tuffaceous rocks, locally interrupted by sedimentary structures. 3. Yamal'skiy type. These shorelines are detectable from closer distances (by 20-60%) than the Dikonskiy type. They consist of clayey and sandy material and are easily eroded. 4. Lenskiy type. These shorelines have a poor reflectivity. They consist of unconsolidated lowland accumulative-alluvial deposits. 5. Glacial type. The radar reflections from this type of shoreline are extremely weak. Interpretation problems are discussed. [189-5303]

"SEVER-31" EXPEDITION ON "SP-22" STATION COMPLETED

Moscow PRAVDA in Russian 28 Dec 79 p 6

[Article by V. Pereverzin: "Fires Amidst the Ocean"]

[Abstract] The article recounts a visit to the ice floe on which the Arctic drifting station "Severnnyy Polyus-22" (SP-22) is located and it reports on the station's recent path of drift and on activities of its research team. The SP-22 station, which was set up in September 1973 is said to be unique from the standpoint of length of service and path of drift. [See the Daily SNAP, 2 February 1979, p 3, column 2] The article reports that the station passed close to Jeannette Island at the beginning of November 1979 and then began to approach Henrietta Island on which the ice-berg carrying the earlier drifting station SP-14 had broken up. Viktor Serafimovich Rachkov, the head of SP-22 and formerly a member of the SP-14 contingent, recalled how the breakup had forced the evacuation of the earlier station. The SP-22, however, bypassed the islands and headed in the direction of the pole. The thickness of SP-22's ice floe, which was originally 28 meters, reportedly has decreased by 6 meters during the years that the station has been drifting.

The article mentions some meteorological and oceanographic observations in progress at the station. Synoptic information is being transmitted by radio from SP-22 at three-hour intervals. Aerological information -- including data on the temperature of the air and the underlying surface, wind velocity, relative humidity and air pressure -- is being sent out twice daily. Engineer-oceanologist A. A. Luk'yanchenko is making measurements of the temperature and salinity of water at various depths. Igor' Alekseyevich Mel'nikov, an associate of the Institute of Oceanology of the USSR Academy of Sciences, makes dives through holes in the ice floe for the purpose of studying marine life. For the first time he is planning to make these dives during the polar night.

[170-P]

SPATIAL STRUCTURE OF ANTARCTIC CIRCUMPOLAR CURRENT

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 250, No 3, 1980 pp 738-741

[Article by E. I. Sarukhanyan, Arctic and Antarctic Scientific Research Institute, "Spatial Structure of the Antarctic Circumpolar Current in the Region Between Africa and Antarctica"]

[Abstract] One of the principal objectives of the "POLEKS-Yug-79" experiment, carried out during the period December 1978-February 1979 in the region between Africa and Antarctica by the research ships "Professor Vize" and "Professor Zubov," was a study of the spatial structure of the Antarctic

Circumpolar Current on the basis of the results of an oceanographic survey in the region from 35 to 56°S and from 10 to 30°E and on the basis of data from long series of instrumental measurements at anchored buoy stations with submerged buoys. The discreteness of the survey was 1° in latitude and 2°.5 in longitude. The results of this oceanographic survey were used in computing maps of dynamic topography relative to the 3000 db surface. It was found that in the considered region there are two systems of currents. In the region from 35 to 42°S is the Agulhas Current, moving from northeast to southwest; it turns in the region 10-15°E and heads eastward, approximately along latitude 40-42°. This branch of the Agulhas Current has been interpreted in the past as a northerly offshoot of the Antarctic Circumpolar Current. However, an analysis of the spatial structure of the flow and the characteristics of the waters transported by it shows that the Agulhas Current transports from the Indian Ocean into the Atlantic Ocean and back subtropical waters differing sharply in their temperature and hydrochemical characteristics from the subantarctic waters to the south. The Antarctic Circumpolar Current attains its maximum development in the latitude zone 47-51°. This current maintains a stable general easterly direction to the deep horizons, virtually to the bottom (this is made clear in Table 1 and Fig. 2). The current velocity decreases monotonically with depth, being 20-25 cm/sec in the surface layers and 3-6 cm/sec near the bottom. The maximum current velocities can attain 50 cm/sec. The principal peculiarities of vertical structure of the Antarctic Circumpolar Current are shown in Fig. 3. Estimates of the geostrophic transport of waters in the zone of the Antarctic Circumpolar Current from the surface to the bottom, carried out using data from 9 sections from 10 to 30°E, average $10^6 \text{ m}^3/\text{sec}$. Figures 3, tables 1; references 9: 7 Russian, 2 Western. [206-5303]

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